The Next Stage in Evaporative Cooling

The Problem

Evaporative coolers in residential applications save energy compared with conventional vapor-compression air conditioners. However, traditional evaporative units must move large quantities of air to achieve adequate cooling. Moving all that air generates a lot of noise and leads to the need to directly exhaust that air. In many cases, exhaust is accomplished simply by opening windows, which can introduce wind-borne dust and raise security concerns.

The Solution

A new 3-ton equivalent evaporative cooler called the OASys (**Figure 1**) addresses these problems by using both direct and indirect evaporative cooling. This two-pronged approach produces a greater temperature drop, thereby reducing the volume of air required. The OASys also uses less energy than conventional evaporative coolers. The system was developed by the Davis Energy Group, an HVAC consulting company, and is manufactured by Speakman CRS, a manufacturer of clean and sustainable technologies.

Features and Benefits

The OASys packages heat exchangers and airflow paths in a unique way, providing energy-efficient operation as well as improved comfort.

Energy and demand savings. The OASys features an efficient new counter-flow heat exchanger and an innovative routing of air within the unit that effectively adds a third stage to the cooling process (**Figure 2**). This results in an annual energy savings of approximately 80 percent and demand savings of 80 to 90 percent compared with vapor-compression air conditioners.

Federal efficiency standards establish a minimum seasonal energy-efficiency ratio (SEER) of 13 for vapor-compression single-package units. The OASys, with a SEER of better than 40, far exceeds the standard. However, this rating is limited as a measure of efficiency improvement, because the OASys was tested under different conditions than the Air Conditioning and Refrigeration Institute uses for testing conventional air conditioners.

Reduces the need to open windows. Although the OASys still requires the use of dedicated exhausts, the reduction in airflow makes it easier to rely on passive pressure-release exhaust vents that can be mounted in the ceiling, eliminating the need to open windows.

Introduces less humidity. The OASys cools outdoor air in an indirect evaporative stage before sending it through a direct evaporative stage. Therefore, the system introduces less moisture into a building than a conventional single-stage direct evaporative cooler (**Table 1**, next page).

Figure 1: A cooling OASys

The external shell of the newly available commercial version is smaller than that of prototype units and allows for easier access to internal components.

Figure 2: OASys airflow patterns

The OASys uses both direct and indirect evaporative cooling.

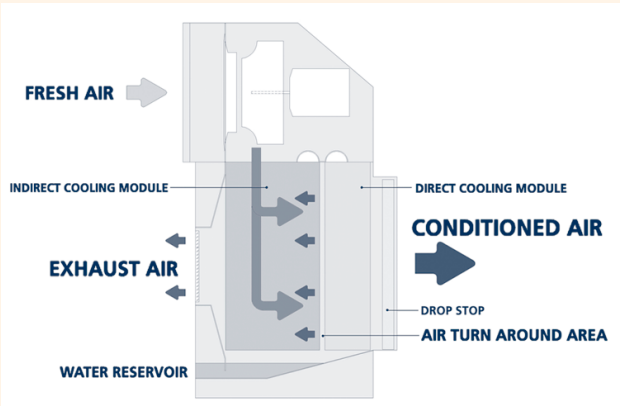

Table 1: OASys introduces less humidity

As the data for two different climates show, by cooling outdoor air with an indirect evaporative stage, the OASys would bring less moisture into a building than a comparable conventional evaporative cooler would.

	Sacramento	Denver
Indoor temperature (F)	78	78
Outdoor drybulb temperature (F)	100	93
Outdoor wetbulb temperature (F)	70	60
Indoor relative humidity with OASys (%)	60	37
Indoor relative humidity with a conventional evaporative cooler (%)	70	47

Note: F = Fahrenheit.

Resists corrosion. Unlike traditional evaporative coolers, the OASys uses a molded plastic cabinet that resists corrosion.

Offers competitive cost. With an uninstalled cost of around $2,500, the OASys is competitive with comparable air conditioners. This should lead to an immediate payback in all regions where evaporative cooling cuts energy consumption.

Applications

The OASys is suitable for residential applications in hot and dry climates (where the mean coincident wet-bulb temperature is below 70° Fahrenheit), which include many parts of the southwestern and mountain state regions of the United States. Applications that require large amounts of fresh outdoor air—such as modular classrooms, gymnasiums, and commercial kitchens—are also good candidates for this technology. However, regions with scarce water resources will need to consider the OASys's site water use: 6 to 11 gallons per hour.

California Codes and Standards

Under the present standards, either direct or indirect/direct evaporative coolers may be used, subject to the eligibility and installation criteria cited in the current "Alternative Calculation Method (ACM) Manual." Credits in the 2005 ACM Manual assume 11 SEER for a direct system and 13 SEER for an indirect/direct system, with either type of system using R4.2 to R8 ducts in the attic, depending on duct leakage testing and type of construction. Increased credits in future standards would encourage wider use of evaporative cooling.

What's Next

Speakman CRS continues to build a base of installation contractors through which the product is sold, and a project demonstrating the OASys's suitability for use in mobile classrooms will be conducted with San Diego Gas & Electric. Speakman CRS is also developing an OASys model with an integrated heating element. Additional future products may include an integrated photovoltaic power source or a small vapor-compression air conditioner to enable use of the two-stage evaporative technology in a broader range of conditions.

Collaborators

The organizations involved with this project are the Davis Energy Group and Speakman CRS. Additional funding for this project was provided by the Sacramento Municipal Utility District.

For More Information

Detailed reports on this project are available online at http://www.energy.ca.gov/reports/2004-04-07_500-04-016.PDF

To view Technical Briefs on other topics, visit www.esource.com/public/products/cec_form.asp.

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About PIER

This project was conducted by the California Energy Commission's Public Interest Energy Research (PIER) Program. PIER supports public-interest energy research and development that helps improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

Arnold Schwarzenegger, *Governor*

For more information see www.energy.ca.gov/pier

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